

## Analytical Methods for Determining the Fraction of Organic Carbon

**Background:** One non-default option for a facility is to calculate a site specific closure level by determining the fraction of organic carbon ( $f_{oc}$ ) in the soil. The  $f_{oc}$  is used in Equation 7-1 in the RISC Technical Guide. For organics, the soil-water partition coefficient,  $K_d$ , is the chemical-specific soil organic carbon-water partition coefficient times the fraction organic carbon;  $K_d = K_{oc} \times f_{oc}$ . Section 7.1.5 notes that no single method is recommended for determining  $f_{oc}$ .

“Organic carbon” is only part of the “organic matter” in soil. Depending on whether a method determines organic carbon or organic matter, a correction factor is used to calculate the desired result. The most common correction factor is 58% organic carbon in the organic matter. There are three types of methods that are appropriate to determine organic carbon.

**Dry Oxidation Methods.** One example is the American Society for Testing Materials, D2974. In these methods, a dry sample is subjected to elevated temperatures and all the organic matter is burned off. Some methods measure the carbon dioxide produced and others measure the loss of mass on ignition. The results obtained from the test is multiplied by 58% (or divided by 1.74) to determine  $f_{oc}$ .

**Wet Oxidation Method.** This method, commonly called the Walkley-Black method, uses chemical oxidizing agents to oxidize the “easily oxidizable organic carbon”. This test measures the  $f_{oc}$  directly and so there is no correction factor. This method was considered the standard by soil scientists for determining organic matter, i.e., applying the correction factor. However, because of the reagents used, the residues are likely to be a hazardous waste.

**Extraction Methods.** These methods estimate  $f_{oc}$  based on the color, either by visual comparison or by spectrophotometer. Soil is mixed with a basic solution of EDTA and filtered. The color of the filtrate is compared to known standards.

**Inappropriate Methods.** One method IDEM cannot recommend is Total Organic Carbon, e.g., SW-846 9060. The method was developed for ground water, surface water or wastes. One of the method’s stated interferences is high carbonates, such as might be found in soil. Even with precautions listed in the method, IDEM believes the method is biased high when used for analyzing soil. Results submitted to IDEM have had values 4-5 times the expected maximum  $f_{oc}$ .

**References:** besides the references listed in Section 7.1.5, there are several internet sites available.

<http://ag.udel.edu/extension/information/prod%5Fagric/chap8-95.htm>

<http://www.statlab.iastate.edu/soils/nssc/ssir42/ssir42.htm>

[http://www.statlab.iastate.edu/soils/nssc/use-man/est\\_som.pdf](http://www.statlab.iastate.edu/soils/nssc/use-man/est_som.pdf)